



# DEPARTMENT OF CONSERVATION

## OFFICE OF MINE RECLAMATION

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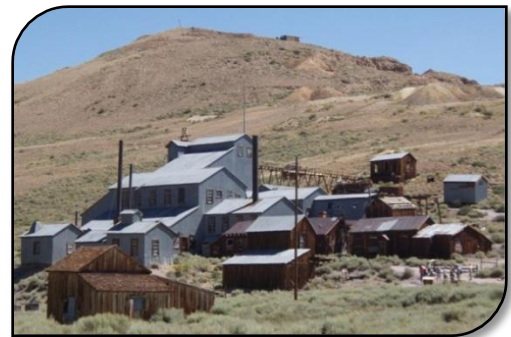
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## OMR Environmental Hazard Remediation & Reclamation Projects

The Department of Conservation's Office of Mine Reclamation (OMR) has conducted or participated in a number of remediation strategies to mitigate environmental hazards associated with abandoned mines. Several of these projects are described below.

### Bodie State Historic Park (SHP), Mono County

In the late 1800s to early 1900s, the town of Bodie was part of a major gold mining district. In 1962, the town and adjacent area became Bodie SHP, which is owned and managed by the Department of Parks and Recreation (State Parks). The park is preserved in a state of "arrested decay," and a critical priority for State Parks is to maintain the appearance and historical setting of mining, including structures, artifacts, tailings, and other cultural resources. As a consequence of mining and gold processing, however, Bodie was contaminated by lead, mercury, and arsenic. Lead was used in the assay process (which allows for measurement of the amount of gold in an ore sample). Mercury was used as amalgamate with gold to enhance recovery. Arsenic is commonly associated with gold deposits and occurs naturally in the area.



Bodie SHP's Standard Mill

In 2006, the State Legislature appropriated funds from OMR's Surface Mining and Reclamation Account to "remediate specified chemical hazards" (Assembly Bill 1801, Item 3480-001-0035). Using these funds, OMR coordinated with State Parks and the U.S. Environmental Protection Agency (USEPA) to investigate and remediate chemical hazards at Bodie SHP to protect human health and safety. The USEPA conducted the sampling and remediation work (locations and procedures were designed to fully characterize and remediate any contaminants and protect cultural resources and artifacts), which was monitored by State Parks' archaeologists and OMR staff. The project, which was completed in June 2009, included the following tasks.

- Installed a modified radon extraction system to reduce mercury vapor concentrations inside the Standard Mill and remediated lead-contaminated soil on slope below the Mill (placed filter fabric and clean fill, revegetated slope, and installed fences to reduce disturbance).
- Remediated lead-contaminated soil from Bell and Rose Klyps Assay buildings (removed top foot of soil in and around buildings; replaced soil with clean fill).
- Removed lead contaminated dust in Wheaton-Hollis Hotel using a HEPA vacuum.
- Controlled erosion of mine tailings adjacent to Bodie Creek by building a diversion channel lined with rocks collected onsite to carry runoff away from the tailings, by constructing weirs in the creek to slow stream flows, and by composting and revegetating the tailings to promote growth of native plants.



A lined diversion ditch (right side of photo) prevents runoff from eroding mine tailings.

## Spenceville Mine, Nevada County



### BEFORE

### AFTER

Spenceville Mine was a copper mine that operated from 1875 through 1918. Problems with the abandoned open-pit mine included acid mine drainage (AMD) and the forming of an open pit lake in the abandoned mine workings. The mine water had a pH of about 2.5 with elevated levels of iron, copper, and zinc. During high precipitation, water from the pit overflowed into Little Dry Creek, which is under the jurisdiction of the Department of Fish and Game (DFG). Under contract with DFG, OMR developed a strategy to mitigate the AMD and reclaim the mine site to a safe and stable condition. OMR's objective was to identify and select a low-cost, low-maintenance treatment strategy that would: (1) prevent future discharges to state waters by cleaning up and containing AMD and associated heavy metal problems onsite; (2) provide a stabilizing vegetative cover; and (3) meet Central Valley Regional Water Quality Control Board (RWQCB) requirements. OMR's contract work included three phases:

- **Phase 1.** Evaluate existing site conditions and the adequacy of existing information on the site contained in previous studies. Gather additional site data, as needed.
- **Phase 2.** Multiple tasks, including: evaluate alternative control strategies; conduct a feasibility study; develop conceptual design criteria for alternative strategies; estimate capital, operating, and maintenance costs for the proposed alternatives; select an abatement and remedial strategy based on the feasibility study and testing; and prepare a preliminary design report for the recommended source control and cleanup alternative.
- **Phase 3.** Develop biddable plans and specifications for the selected strategy.

Upon completion of Phase 3, DFG contracted with a private firm to implement site remediation and with OMR to provide an Engineer-In-Charge to oversee the contractor's work.

## Walker Mine, Plumas County



The Walker Mine pit backfill project was part of an effort by the Central Valley RWQCB to mitigate water quality impacts of this abandoned Plumas County copper mine. Previous RWQCB efforts included construction in the 1980s of a concrete seal near the mill site to stop discharges of acidic waters into an adjacent creek and the construction in the 1990s of drainage channels to capture and redirect runoff. In 2003, the RWQCB contracted with OMR to conduct site-specific studies to evaluate the potential impacts of backfilling the pits



and modifying channels where adjacent springs were not fully captured. OMR conducted field and office studies throughout 2003 and 2004, prepared plans and contract documents to implement a pit backfilling and channel modifications project, and prepared a final report that presented the findings and recommendations from its investigations.

## **Other OMR Abandoned Mine Reclamation Projects**

### Gambonini Mercury Mine, Marin County

During historic mining at the Gambonini Mercury Mine, mine wastes were placed in a steep canyon covering an area of about 11 acres. Consequently, large quantities of mercury-laden sediment would discharge each year into Salmon Creek—a tributary to Walker Creek and Tomales Bay. Threats to the beneficial uses of these waters included degradation of fish spawning areas in Walker Creek and bioaccumulation of mercury by wildlife and fish in Tomales Bay. Under contract with the San Francisco Bay RWQCB, OMR conducted the tasks listed in Table 1 (see page 4).



### Leviathan Mine, Alpine County

Leviathan Mine is an abandoned open-pit mine high on the eastern slope of the Sierra Nevada southeast of Lake Tahoe that was placed on the USEPA National Priority List (Superfund) in May 2000. The Toiyabe National Forest surrounds the site. Although some mining for copper minerals took place onsite since the 1860s, major environmental problems originated during the open-pit sulfur mining that occurred from 1951 through 1962.

Several hundred acres of eroding disturbance remain at the mine as a consequence of the historic mining operations. This disturbance consists of the open pit, overburden, and mining waste piles. Barren conditions of the site have increased AMD generation, pollutant transport, and slope instability resulting in discharges to Leviathan and Aspen Creeks of low pH AMD containing high concentrations of dissolved sulfate, arsenic, nickel, aluminum and iron. Under contract with the Lahontan RWQCB, OMR conducted the tasks listed in Table 1 (see page 4).

### Sulphur Bank Mercury Mine, Lake County

Sulphur Bank Mercury Mine, once one of the largest producers of mercury in California, was initially mined for sulfur from 1865 to 1871. Mercury ore was mined intermittently by underground methods from 1873 to 1905. The site periodically was opened for pit mining from 1915 to 1957, when it became inactive. Approximately 120 acres of mine tailings and waste rock and an open, unlined mine pit (called the Herman Impoundment) were located on the property. After mercury was found in the tailings and bottom sediments in Clear Lake, and high levels of mercury were detected in fish from the lake, the State issued an advisory against eating fish from the lake. Under contract with the USEPA, OMR conducted the tasks listed in Table 1 (see page 4).



**Table 1. OMR Contracted Mine Reclamation Tasks**

		<b>Gambonini Mercury Mine</b>	<b>Leviathan Mine</b>	<b>Sulphur Bank Mercury Mine</b>
<b>TASKS</b>		<i>San Francisco Bay RWQCB</i>	<i>Lahontan RWQCB</i>	<i>USEPA</i>
<b>Plant Propagation</b>	Collected seed and cuttings from the mine area and obtained nursery services to cultivate plants for revegetation test plots and full-scale implementation.	<b>x</b>	<b>x</b>	<b>x</b>
<b>Test Plot Design &amp; Construction</b>	Designed and planted revegetation test plots.	<b>x</b>	<b>x</b>	<b>x</b>
	Monitored test plots to evaluate success.	<b>x (2 years)</b>	<b>x (5 years)</b>	<b>x (5 years)</b>
<b>Review of Existing Data</b>	Reviewed the existing geological, chemical, soil, and physical data pertinent to the design of a remediation plan.	<b>x</b>	<b>x</b>	<b>x</b>
<b>Evaluation of Existing Site Conditions</b>	Conducted surveys for listed species on the mine site, surveyed site vegetation, inventoried the types of native plant species growing on site, and assessed which species were most likely to succeed in a revegetation project.	<b>x</b>	<b>x</b>	<b>x</b>
	Prepared and implemented field sampling plan to evaluate soil types, nutrient content, and organic matter content of mine area soils to determine what types of soil additives or clean soil cover were necessary for revegetation to succeed.	<b>x</b>	<b>–</b>	<b>–</b>
<b>Waste Pile Stabilization or Revegetation Plan</b>	Prepared grading plan to excavate portions of the mine waste rock dump and fill the existing open pit; the goal was to establish a final grade for the waste rock dump that would be stable and could be revegetated.	<b>x</b>	<b>–</b>	<b>–</b>
	Performed statistical analysis on data to determine if the trends identified were supported by statistical analyses.	<b>–</b>	<b>x</b>	<b>x</b>
	Conducted geophysical surveys documenting the use of new technologies for discerning underground seeps and voids.	<b>–</b>	<b>x</b>	<b>–</b>
	Prepared a final report documenting the relative success of various revegetation treatments and submitted a proposal for the overall waste stabilization strategy for entire mine area.	<b>x</b>	<b>x</b>	<b>x</b>
<b>Provision of Botanical Expertise</b>	Established permanent seed collection locations.	<b>–</b>	<b>x</b>	<b>–</b>
	Provided input on weed control strategies.	<b>–</b>	<b>x</b>	<b>x</b>
	Provided remedial measures for revegetation.	<b>–</b>	<b>x</b>	<b>x</b>
<b>Creek Remediation</b>	Coordinated with contractor to determine treatment options to remediate impacted creek.	<b>x</b>	<b>–</b>	<b>–</b>
<b>Construction Monitoring</b>	Provided construction monitoring and oversight for site grading, resoiling, erosion control and revegetation during the full implementation phase of the remediation plan.	<b>x</b>	<b>–</b>	<b>–</b>
<b>Short-term Monitoring</b>	After full-scale implementation, monitored soil nutrient availability, erosion potential, and revegetation of the remediated slope.	<b>x</b>	<b>–</b>	<b>–</b>